

INK JET FAULT TOLERANCE USING OVERSIZE DROPS

Field of the Invention

This invention relates to digital printing and more particularly to printing
5 using devices which eject ink onto the printed substrate. However, the invention is
not limited to ink ejection devices and is also applicable to laser, light emitting diode
printers and to digital photocopiers.

Background of the Invention

10 In ink ejection devices a printhead has an array of nozzles through which ink
is selectively ejected onto the substrate as the substrate moves relative to the
printhead. The printhead may print by scanning across the substrate to print
horizontal bands or, if it is a full page width printhead, it may pass along the length
of the page. A blocked nozzle will result in multiple horizontal blank lines, in the
15 case of a scanning type printhead, or a blank vertical line in the case of a page width
printhead. Such blank lines are undesirable since they detract from the printed result.

The present invention provides a method of modifying the printing of an
image so as to reduce or effectively eliminate the visual effect of one or more such
blocked nozzles apparent to the eye of an observer in normal use. However, the
20 invention is applicable to other forms of printing where a device, whether passive or
active, is repeatedly used to produce dots of ink or the like on a substrate. The
invention has potential application to laser and LED type printers and photocopiers
where a fault in the imaging drum or light source can result in repeated faults in the
image produced. As used above and throughout the description and claims the term
25 image is to be understood to have a broad meaning and includes anything printed,
such as text and line drawings.

Disclosure of the Invention

In one broad form the invention provides a method of modifying an image to be digitally printed by a printing device to compensate for failure to correctly print dots of ink at specific locations, the method including the steps of:

- a) identifying said specific location or locations, and
- b) adjusting the dot size of at least one a dot at a location adjacent or near to the respective specific location from that required by the image data.

In another broad form the invention provides a printer having a row of activatable devices which, when activated, cause rows of dots to be deposited onto a substrate and means to move the substrate relative to the row of devices in a direction generally perpendicular to the row of dots, said printer including:

- a) means to determine if one or more of said devices is not operating correctly; and
- b) control means for analysing images or image data and for identifying a specific location or locations where a dot of ink should be printed by activation of a incorrectly operating device and for adjusting the size of dot produced by one or both of the devices on either side of the failed device.

The incorrectly operating device will result in a defect line or lines in the image printed. Usually the incorrectly operating device will produce no ink or not enough ink and so a blank or faint line will be produced. To compensate adjacent ink dots will be caused to be larger than required by the raw image data. Conversely if the incorrectly operating device is producing oversized ink dots, the dot size of adjacent dots will be reduced.

Where a part of an image requires the incorrectly operating device to deposit a continuous or substantially continuous column of dots, the dots in adjacent columns are preferably all adjusted in size. If there are a small minority of locations in the column of the incorrectly operating device which do not require ink, dots in adjacent columns may or may not be adjusted in size.

Dots in more than the two adjacent columns may be adjusted in size. Dots in adjacent columns may be adjusted in size only if they are within predetermined vertical or horizontal distances or both of one or more specific location. For example only dots in the columns either side of the failed column may be adjusted in size but dots in those columns two or three rows above and/or below the respective location may be adjusted in size.

Brief Description of the Drawings

The invention shall be better understood from the following non-limiting description of preferred embodiments and the drawings, in which

Figure 1 shows a schematic illustration of a set of nozzles of an ink jet printing head.

Figure 2 shows a schematic illustration of an array of ink dots formed by the printhead of Figure 1 without fault correction operational.

Figure 3 shows a schematic illustration of the same array of ink dots as in Figure 2 formed by the printhead of Figure 1, but with fault correction operational.

Figure 4 shows a second schematic illustration of an array of ink dots formed by the printhead of Figure 1 without fault correction operational.

Figure 5 shows a schematic illustration of the same array of ink dots as in Figure 4 formed by the printhead of Figure 1 but with fault correction operational.

Description of Preferred and Other Embodiments

Referring to Figure 1, a printhead 10 has an array of ink jet nozzles 12 arranged in a single line. For the purpose of explanation only 14 nozzles are shown but in practice there will be from tens to thousands of nozzles arranged in a line. Paper is passed underneath the printhead in a direction generally perpendicular to the line of ink jet nozzles, as indicated by arrow 14. The printhead may be a stationary or a movable printhead. As the paper passes under the printhead the ink jet nozzles A to N are selectively operated to cause an array of ink dots to be placed on the paper. This array is a series of columns and rows, the spacing of which is dependent on the

5 down a series of transverse bands of printing.

10 correctly. In most cases, a malfunctioning device will be partially or totally blocked

shows the same image printed by the printhead 10 but with fault correction

25 paper for reading at normal distances, such as at 20 to 30cm, the effect occurs at

30 columns either side of the failed column in locations when the image data does not

5

10

20

25

mechanical type ink ejection devices the pulse width and/or driving voltage or current may be increased.

The invention is also applicable to situations where individual devices are producing too much ink, in which case the adjacent devices may be adjusted to
5 reduce the dot size of ink dots produced.

It will also be appreciated that this technique may be used with laser and LED printers and photocopiers and other types of digital printers where the placement of an ink dot is dependent on individual activation of a device or component. For example, an LED in a LED printer may fail or there may be a defect in the photoconductive imaging drum of a laser printer. In both cases, adjusting the size of adjacent dots can hide or reduce the visual effect of the defect in the device or component.

In the case of a laser or light emitting device type printer dot size may be modified by modulating the intensity and or total amount of the light falling on the corresponding portion of the photoelectric imaging drum.